PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau

B3

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G08B

A2

(11) International Publication Number: WO 97/13230

(43) International Publication Date: 10 April 1997 (10.04.97)

(21) International Application Number: PCT/GB96/02343

(22) International Filing Date: 23 September 1996 (23.09.96)

(30) Priority Data:
9519261.3 21 September 1995 (21.09.95) GB

(71)(72) Applicants and Inventors: FARRAGHER, Patrick, Joseph [IE/GB]; The Dower House, Water Eton Manor, Oxford OX2 8HE (GB). CURRAH, Stephen, Thomas [GB/GB]; The Old Rectory, Howick, Alnwick, Northumberlan NE66 3LE (GB).

(74) Agents: EVERITT, Christopher, James, Wilders et al.; F.J. Cleveland & Company, 40-43 Chancery Lane, London WC2A 1JQ (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

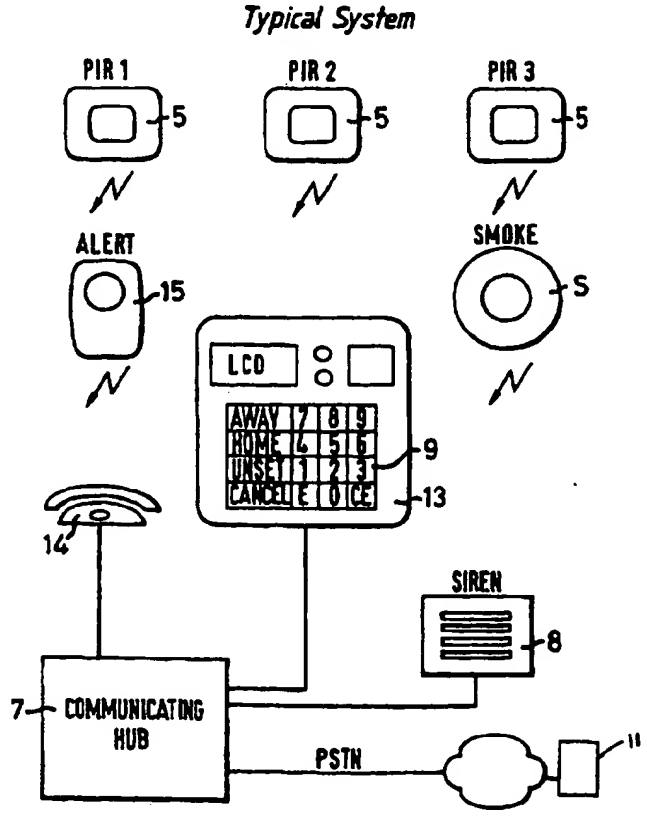
Published

Without international search report and to be republished upon receipt of that report.

(54) Title: A SECURITY SYSTEM

(57) Abstract

A security system comprising a monitoring centre (11) connected through a communication system to at least one control means (7) at at least one remote location, there being a two-way audio communication link between the control means (7) and the monitoring centre (11) and at least one detector (5) associated with the control means (7). Each detector (5) is operable to transmit a detector signal carrying information which can be recognised by the control means (7) as indicating whether or not there is a potential alarm situation. When such an alarm situation is detected by the control means (7) it sends an alarm signal to the monitoring centre (11). From the alarm signal received, the monitoring centre (11) is able to identify the location at which the alarm situation is occurring as well as the nature of the emergency, so that appropriate assistance can be requested.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

A SECURITY SYSTEM

This invention relates to a security system, in particular to a security system for use in a domestic situation.

GB 2,167,625 B discloses a remote subscriber interaction system which comprises a scanner connected through the public telephone network to a subscriber unit at a location remote from the scanner. The subscriber unit is in communication with various instruments at the remote location, which instruments are operable to send a signal to the subscriber unit when an alarm situation is detected thereby. In a normal non-alarm situation, the subscriber unit transmits a continuous below audible signal to the scanner. However, if any one of the instruments detects an alarm situation, the continuous signal is interrupted so that the scanner is informed of the alarm situation. As a result of this the scanner automatically sends an interrogating signal to the subscriber unit. In response to the interrogating signal, the subscriber unit provides the scanner with information on the source of the alarm. The interrogating signal and the subsequent response are each transmitted in the audible frequency range.

A problem with a system of the type described in GB 2,167,625 B is that the subscriber unit has to permanently transmit a signal to the scanner. In addition, there are no provisions which enable the scanner to assess the risk of an alarm signal being false. Furthermore, the scanner is not immediately informed of the source of the alarm signal but instead has to send an interrogating signal to the subscriber unit.

According one aspect of this invention there is provided a security system comprising a monitoring centre connected via a communication system to control means at a remote location. and at least one detector associated with

said control means, each detector being operable to detect an alarm situation and transmit a detector signal to said control means, wherein on receipt of said detector signal said control means is operable to inform said monitoring centre of said alarm situation, characterised in that said control means is operable to inform said monitoring centre of said alarm situation by sending an alarm signal thereto and a two way audio communication link is provided between said control means and said monitoring centre, so that on receipt of said alarm signal from said control means said monitoring centre is able to verify the alarm situation by using the two way audio communication link, thereby reducing the risk of false alarms.

According to another aspect of this invention there is provided a control system for use in a security system, which control system comprises control means for connecting to and communicating with a monitoring centre at a remote location, at least one detector associated with said control means, each detector being operable to detect an alarm situation and transmit a detector signal to said control means, wherein on receipt of said detector signal said control means is operable to inform said monitoring centre of said alarm situation, characterised in that said control means is operable to inform said monitoring centre of said alarm situation by sending an alarm signal thereto, and said control means is adapted to be connected to said monitoring means so that a two way audio communication link is formed between said control means and said monitoring centre, so that on receipt of said alarm signal from said control means said monitoring centre is able to verify the alarm situation by using the two way audio communication link, thereby reducing the risk of false alarms.

Preferably said detector signal transmitted by each detector is a unique such signal which carries information identifying said detector and said control means is operable to recognise said detector signal, wherein said control

means is operable to transmit alarm signals corresponding to detector signals from specified detectors to said monitoring means, so that on receipt of said alarm signal from said control means said monitoring centre is able to identify the detector from which said alarm signal originated and which of the detectors are specified, so that by using the information on the said detectors in cooperation with the two way audio communication link said monitoring centre is able to verify the alarm situation.

Preferably the control means has two modes of operation, in a first one of which all of said detectors at said remote location are specified and in a second one of which not all of said detectors at said remote location are specified. The first mode is an 'away' mode which may be used to set the system when the remote location is unoccupied. The second mode is a 'home' or 'unset' mode which may be used to set the system when the remote location is occupied. Preferably, in the 'home' mode the control means is operable to send alarm signals to the monitoring station only from detectors in a specified zone of the remote location. The 'unset' mode may be such that the control means is operable to send alarm signals to the monitoring centre from a specified type of detector. The specified type of detector may be, for example, a smoke detector. A combination of the home and unset modes may be used.

The monitoring centre may verify the alarm signal when the system is in the home or unset modes by using the two-way communication link to enable a conversation between the system user and the monitoring centre. When the system is in the away mode the monitoring centre may verify an alarm signal using the two-way communication link to enable the monitoring centre to monitor sounds at the remote location. The monitoring centre may also be able to detect the sequence of activation of the detectors, thereby assisting in the assessment of the risk.

The communication system may be the public switched telephone network system (PSTN) or integrated services digital network (ISDN) or a cellular or radio telephone network system or a cable network system.

Preferably said at least one detector is in wireless communication with said control means. The at least one detector may be for example a smoke detector, a detector for detecting the presence of intruders, a flood detector, a gas detector, for example carbon dioxide, and other such detectors.

There may also be provided a user activatable alarm operable to transmit a signal to said control means, which user activatable alarm may be activated manually or by using a radio signal which is transmitted from a unit carried by the user.

Preferably the control means is set in a given mode using a key pad data entry system or a touch tone telephone. The control means may alert the monitoring centre by dialling predetermined telephone numbers to open a line or channel of communication and then sending a signal along that line or channel.

The control means may be provided with means operable to delay alerting the monitoring centre when a signal indicating an alarm situation has been received until a preselected time has elapsed, in order that a user can reset the system before an alarm signal is sent to the monitoring centre, when, for example, a detector has been activated but there is no alarm situation.

Programmable timing means may also be provided in the control means, so that after a preselected period of time a request signal is automatically sent from the control means to the monitoring centre to request that routine management and maintenance checks are conducted.

The system may also be provided with a siren or some other audio alarm connected to the control means, said audio alarm being operable to sound when an alarm signal is sent to the monitoring centre.

When a cellular or radio telephone network or other such network is used as the communication system for the security system, there is no physical line of communication which can be cut. This overcomes a problem associated with known security systems which utilise for example a public switched telephone network (PSTN), as such security systems can be disabled by potential intruders merely cutting the line. In order to prevent this, such security systems often take advantage of line monitoring services provided by PSTN service providers, which monitoring services raise an alarm whenever the line is broken. However, line monitoring services are expensive and so effectively limit the availibility of such security systems. Therefore, since a security system which utilises a cellular or radio telephone network system does not need a line monitoring service, this reduces the overall cost of that security system and so makes it more generally available.

According to yet another aspect of this invention there is provided a system comprising control means operable to store predetermined information on the average movements of a person over a preselected time interval, monitoring means operable to monitor the actual movements of the person over that time interval, and transmitting means operable to transmit information on the actual movements from the monitoring means to the control means, said control means being operable to compare the information on the actual movements of the user with the stored information, wherein any absence of movement would result in an alarm being raised. The alarm may be a siren operable to attract attention to the plight of the user. Alternatively, the control means may be connected through a communication systen, for example the public telephone network service, to a monitoring centre to which an alarm signal can

be sent. A two-way communication link between the monitoring centre and the control means may be provided. When an alarm is raised the two-way communication link may be used to contact the user to establish whether or not they require assistance. In addition detectors may be provided, each detector being operable to detect an alarm situation and transmit a detector signal to said control means, wherein on receipt of said detector signal said control means is operable to inform said monitoring centre of said alarm situation by sending an alarm signal thereto, so that on receipt of said alarm signal from said control means said monitoring centre is able to verify the alarm situation by using the two way audio communication link.

According to a further aspect of this invention there is provided a self testing detector comprising detecting means operable to detect a preselected physical change and send an alarm signal to activate alarm means when such a change is detected, and simulating means operable automatically to produce a signal which causes said detecting means to react as though it detected said physical change.

The detector may be a smoke or gas detector comprising detecting means operable to detect the presence of smoke or gas and send an alarm signal to activate alarm means when smoke or gas is so detected. The detector may be an infra red radiation detector comprising detecting means operable to detect the presence of infra red radiation and send an alarm signal to activate alarm means when such radiation is so detected.

Preferably said simulating means comprises a microprocessor. The microprocessor may be operable to produce said simulating signal automatically at periodic intervals, for example every hour.

A security system in which the various aspects of the present invention is

embodied will now be described by way of example with reference to the accompanying drawing which is a diagram of a security system.

The drawing shows a security system comprising a group of peripheral detectors 5 in radio communication with a communication hub 7, which hub 7 is able to communicate with a monitoring centre 11. The detectors 5 and the communication hub 7 are located typically in a user's premises. Also provided at the user's premises is a siren 8, a user unit 13 having a data entry key pad 9 and audio communication means, and a touch tone telephone 14, each of which are connected to the hub 7. The monitoring centre 11 is at a location remote from the communication hub 7 and typically is permanently manned.

The hub 7 is typically connected to the monitoring centre 11 via a communication system such as a public switched telephone network (PSTN) or an integrated services digital network (ISDN) or a cellular or radio telephone network system or a cable network system.

Between the monitoring centre 11 and the audio communication means on the user unit 13 there is a two-way audio communication link, which link is formed through the hub 7 and can be opened from the monitoring centre or the user's premises. In the two-way audio communication link between the monitoring centre 11 and the audio communication means on the user unit 13 voice or other audio signals are typically transmitted through the hub 7 in a manner similar to the transmission of such signals through a private branch exchange (PBX). The audio communication means in the user's premises typically includes a sensitive microphone so that sounds in the user's premises can be readily detected, and so monitored by the monitoring centre 11.

The detectors 5 are typically wireless auto-reporting battery powered detectors. Each detector 5 has a unique identity which is part of its serial number and

each is operable to transmit to the hub 7 a unique signal which can be readily identified. This signal contains information on the status of the detector 5, that is whether or not the detector is detecting a potential alarm situation. Typically each system is provided with passive infra red (PIR) intruder detectors and smoke detectors but may also include flood detectors, gas detectors, for example carbon dioxide detectors, and other such detectors. The intruder detectors should ideally be positioned to detect an intruder entering the premises from any window or door, in particular the main entrance/exit.

Signals transmitted by the detectors 5 are received by the hub 7. The hub 7 is operable to send alarm signals to the monitoring centre 11 via the communication system and has three modes of operation, an 'away' mode, a 'home' mode and an 'unset' mode.

In the away mode the communication hub 7 is operable to send an alarm signal to the monitoring centre 11 in response to a radio signal indicating an alarm situation transmitted from any of the detectors 5. This mode would be used when the premises are left unattended.

In the home mode the communication hub 7 is operable to send alarm signals to the monitoring centre 11 in response to a radio signal indicating an alarm situation transmitted from detectors 5 in a specified zone of the premises. This enables a user of the system to set for example all of the detectors 5 on the ground floor of his premises, whilst leaving the intruder detectors 5 on an upper floor inactive.

In the unset mode the communication hub 7 is operable to send an alarm signal to the monitoring centre 11 in response to a radio signal indicating an alarm situation transmitted from any of a specified group or type of detectors 5. The specified group or type of detectors 5 may be, for example, smoke

detectors. This enables a user to effectively de-activate the intruder detectors but activate the smoke detectors so that people can move freely around the premises but still have the benefit of the enabled smoke detectors.

In each of the modes of operation, the alarm signals sent from the hub 7 to the monitoring centre 11 contain information relating to the mode of operation the hub 7 and the identity and nature of the detector from which the alarm signal originated.

The connection between the hub 7 and the monitoring centre 11 may be a dedicated line or channel or may be the premise's telephone line or channel. In the latter case, the hub 7 is provided with a facility to enable it to clear the telephone line or channel in the event of the line or channel being in use when it is necessary to send a signal to the monitoring centre 11. Alternatively or additionally the hub 7 may utilise a three way calling facility such as those provided by PSTN service providers so that in the event of the telephone line being engaged, there is a "free" line to enable an alarm signal to be sent. Hence, there is always a line or channel available for sending signals from the hub 7 to the monitoring centre 11. This is advantageous because it prevents the alarm system being disabled by a person merely telephoning the premises and engaging the line or channel. This has the further advantage that it is not necessary to ensure that knowledge of the telephone number of the premises is restricted, as mere knowledge of the number will not enable a potential intruder to disable the system.

The user of the system is given a unique personal identification number (PIN) so that the communication hub 7 can only be set in the appropriate mode by the user. The hub can be set in any of these different modes using the data entry key pad 9 which is connected to the monitoring centre 11 via the hub 7. This pad 9 typically has three buttons marked 'away', 'home' and 'unset'. In this

case, the system is set when the user's PIN is entered using the key pad 9 and the appropriate mode button is pressed. Alternatively, the mode may be selected by entering the PIN via the touch tone telephone 14 which is connected directly into the communication hub 7 and then keying in a preselected number for the appropriate mode. The monitoring centre 11 can detect the mode in which the system is set.

In addition to enabling the system to be set the key pad 9 is connected to the audio communication means on the user unit 13 and is provided with a button which is operable to open the two-way audio communication between the user unit 13 and the monitoring centre 11. The monitoring centre 11 is also provided with means operable to open a direct line of audio communication between it and the user unit 13. However, the two-way audio communication link between the audio communication means on the user unit 13 and the monitoring centre can only be opened by the monitoring centre 11 when an alarm signal is received thereby. The two-way audio communication link enables a person in the monitoring centre 11 to converse with the system user. Alternatively, it enables someone in the monitoring centre to listen for sounds in the premises when they should be unoccupied.

An alert button 15 is also provided in the user's premises for use in, say, a medical emergency. The alert button 15 can be activated to transmit a radio signal, again having a unique identity, to the communication hub 7 to indicate an alarm situation. The alert button 15 can be activated manually or by using a radio signal transmitted from a unit which may be carried by a user of the system.

In addition to being used to set the security system, it will be understood that the touch tone telephone 14 can also be used for making telephone calls in the normal manner and communicating with the monitoring centre 11. Furthermore,

the telephone 14 may be used as an intercom to the entry/exit keypad 9 and may be used in conjunction with a clock built into the hub 7 for wake-up calls. Typically the telephone 14 is installed in the user's bedroom, so that the user could set the system in the home mode with say the intruder detectors activated in a lower floor of the house without having to walk through the house to do so, and then subsequently alter the setting so that the lower floor intruder detectors are de-activated.

The user's PIN is never transmitted over the network to the monitoring centre 11 for security reasons. In the event that a user forgets his PIN, the monitoring centre 11 can be contacted immediately using the two-way audio communication link either by using the audio communication means in the user unit 13 or by using the telephone 14. When the monitoring centre 11 is so contacted, the user must identify himself by giving his name, address and a password. The communication hub 7 automatically gives its identity as an additional check. The monitoring centre 11 can then cancel the PIN and a new PIN can be entered by the user.

During installation of the system the premises are divided into zones which define the 'home' and 'away' zones. In the unset mode, detection signals from the intruder detectors do not result in alarm signals being sent to the monitoring centre 11. However, detection signals originating from any of the other detectors will result in an alarm signal being sent to the monitoring centre 11. Also during installation, the serial numbers of each detector 5 are entered in the communication hub 7 along with the preselected telephone numbers for the monitoring centre 11.

When the system is in use and an alarm situation is detected at any of the detectors 5, a radio signal containing information on that alarm situation is transmitted to the communication hub 7. The communication hub 7 responds

by sending an alarm signal to the monitoring centre 11 by dialling a preselected telephone number to open a line or channel of communication and then transmitting the alarm signal along that line or channel to the monitoring centre 11. This alarm signal contains information which enables the monitoring centre 11 to identify the location from which the alarm signal was sent and which of the detectors 5 at that location was activated. In addition the alarm signal contains information relating to the mode of operation of the hub 7, so that when the monitoring centre 11 is alerted to an alarm situation it has knowledge of whether or not the premises should be occupied. When the system is used in the home or unset modes then under normal circumstances the user is able to discuss the situation with the monitoring centre 11. In the situation where the system is set in the away mode, the two-way link enables the monitoring centre 11 to listen for sounds from inside the house and thereby aids the monitoring centre 11 in its assessment of whether or not there is a risk situation. When an emergency situation is confirmed, since the monitoring centre 11 receives signals which enable it to identify which detector 5 is activated. the monitoring centre 11 is able to identify the type of assistance required and request that assistance from the appropriate emergency service. In addition to alerting the monitoring centre 11 on receipt of an alarm signal, the hub 7 may send a signal to cause the siren 8 to be sounded.

In addition to the use of the two way communication link to verify alarm conditions, since the alarm signals contain information identifying the detector 5 from which the alarm signal originated, the monitoring centre 11 can also detect the multiple activation of detectors 5. This helps in the assessment of risk, as it is unlikely that a failure or a false activation of more than one detector would occur at the same time. In addition, the monitoring centre 11 can also detect the sequence of any such multiple activation, thereby enabling the monitoring centre 11 to monitor a pattern of movement of, for example, an intruder moving throughout the premises. Again, this assists the assessment

of the risk. Therefore, when more than one detector is activated, this indicates to the monitoring centre 11 that there is an alarm situation which must be dealt with urgently.

The cooperation between the monitoring centre 11, and the communication hub 7 at the remote location enables alarm signals to be verified, thereby making the system effective and reducing the likelihood of an emergency service being alerted by a false alarm.

When a user leaves his premises unattended the system should be set in the away mode, usually using the data entry key pad 9. If an error is made when typing in the PIN, the user can cancel the number and then retype. A preselected time period is allowed within which the user must vacate the premises before the system is fully set. The set time is indicated by a flashing light and a beeping sounder. When the user returns to the premises and opens the door, the exit/entrance intruder detector detects this but the communication hub 7 does not alert the monitoring centre 11 until a preselected time has elapsed, in order to give the user time to enter their PIN and press the 'unset' button, which prevents a false alarm signal being sent. When the user wishes to set the system in the home mode this can be done using the key pad or the touch tone telephone 14.

The hub 7 can be set up so that when it is set in the away mode then if any of the detectors 5, except an intruder detector at the entry door, are activated an alarm signal is sent to the monitoring centre 11 immediately. In the home mode there is usually a time delay before an alarm signal is sent to the monitoring centre 11, so that if the system is accidentally triggered by the user then they have time to cancel the alarm signal.

The system user is also provided with a 'duress' code. This code would be

used when for example a user was being forced to enter their premises with an unwelcome party. When the duress code number is entered the system appears to close down, but in fact the monitoring centre 11 is automatically alerted to the emergency situation and can react by contacting the appropriate emergency service.

All of the signals transferred between the communicating hub 7 and the monitoring centre 11 are encrypted, in order to increase security.

A system is also envisaged in which information on the average day to day movements of the user of the system is stored in a communication hub 7 and monitors are provided which are operable to monitor the actual movements of the user and transmit that information to the hub 7. The actual movements are then compared by communication hub 7 with the stored information, and any deviation from the normal pattern of movement throughout the day, in particular lack of movement, would result in an alarm signal being raised. The alarm may be a siren operable merely to attract attention to the plight of the user. This system could be fully located at the user's premises, or incorporated into the comprehensive security system described above, with the communication hub 7 connected through a communication system to a monitoring centre 11, to which an alarm signal could be sent. A two-way communication link between the monitoring centre and the communication hub 7 may be provided. When an alarm is raised the two-way communication link may be used to contact the user to establish whether or not they require assistance.

The provision of a two-way voice communication system between the hub 7 and the monitoring centre 11 is highly advantageous as it enables communication between the monitoring centre 11 and the system user. It provides a permanent help line. One of the most common problems in the home security systems industry is keying in the wrong entry/exit code and/or

getting confused with the system operation. By providing a two-way voice communication facility this means that problems can be easily resolved by talking to the user and thereby reduces the risk of false alarms. The two-way communication system also provides a medical and/or emergency alarm system.

Monitoring, programming and testing of the communication hub 7 may be performed from the monitoring centre 11. Remote testing on a periodic basis will ensure that the subscriber's apparatus is functioning correctly. In cases where a fault may exist that fault may be identified before the subscriber is even aware of the fact. When a particular detector 5 is causing a problem through a failure or other false alarm, that device can be put out of service from the monitoring centre 11, leaving the rest of the system in a functional mode until it is convenient for a service engineer to fix the fault.

The detectors 5 may be self testing. The self testing may be effected in each case by automatically producing an electrical stimulus which, if the detector is functioning properly, should cause the detector to believe it is detecting something and then monitoring the detector's response to that stimulus. This can be done using a microprocessor in the detector.

Standard smoke detectors comprise an ionisation chamber which is sensitive to smoke and a detector which is operable to measure any distrubances therein. When any such disturbances are detected an alarm signal is generated and then transmitted. Standard smoke detectors are also routinely provided with a test pin which can be activated manually to create a disturbance in the ionisation chamber, which distrubance should cause the detector to produce an alarm signal. Hence when an alarm signal is produced the user of the detector is reassured that it is still functioning properly, and otherwise the user is made aware of the fact that the detector is faulty.

In addition to the ionisation chamber, the detector and the test pin, the self testing smoke detector of the present invention includes typically a microprocessor, which microprocessor is operable to produce automatically a disturbing signal on the test pin which causes the detector to believe that there is smoke in the ionisation chamber. When the self testing detector is functioning properly, the signal produced at the detector output then causes an alarm signal to be generated, which signal is recorded by the microprocessor but does not result in an alarm signal being sent to the hub 7. When the detector is not functioning properly, an alarm signal is not generated and this is also recorded by the microprocessor. In either case a reporting signal is then transmitted to the hub 7, which reporting signal contains information identifying the detector and whether or not it is functioning properly. When the hub 7 is notified of a faulty detector 5, it transmits a fault signal identifying the faulty detector to the monitoring centre 11.

As regards standard PIR intruder detectors, these comprise an infra red sensor which is operable to transmit a signal to its output when it detects infra red radiation. When such a signal is received at the output an alarm signal is generated and then transmitted. In addition to the sensor and the alarm the self testing PIR detector of the present invention typically further includes a microprocessor, which microprocessor is operable to produce automatically a disturbing signal at the input of the sensor which causes the output to believe that infra red radiation has been detected. The sequence of recording and reporting faults is then similar to that described above for the smoke detectors.

Since faults in the self-testing detectors 5 are reported to the monitoring centre 11 automatically, such faults can be corrected quickly. The self testing detectors 5 may be arranged to run a self test say every hour.

All of the detectors 5 are auto-reporting and so periodically give a status report

to the communication hub 7 that they are still present, working and that the battery is functioning. Preferably the self testing is conducted just before the auto-reporting, so that the results of the self testing can be sent with the auto-reporting signal.

In addition or as an alternative to the self testing, the smoke detectors may be configured to measure the density of smoke detected. This can be done by measuring the mean voltage at the output of the detector, as this voltage is linearly proportional to the density of the smoke in the ionisation chamber. This voltage signal is passed through an analogue to digital converter and the resultant signal is processed in a microprocessor, to determine the smoke density. The final information on the density of the smoke is then transmitted to the hub 7. This information is then sent to the monitoring centre 11. Hence, for example, if cigar smoke is detected, as a result of the density measured this may be differentiated from smoke from a fire, thereby assisting in reducing the risk of false alarms.

A programmable timer may be provided in the communication hub 7, so that after a preselected period of time a request signal is automatically sent from the communication hub 7 to the monitoring centre 11 to request that routine management and maintenance checks are conducted.

In order to further reduce the possiblity of false alarms from the intruder detectors, these may be operable to detect multiple activations in addition to single activations, and possibly several multiple activations and transmit information on such activations to the monitoring centre 11. This information can then be used by the monitoring centre 11 to identify false alarms.

The detectors 5 may contain intelligence operable to randomise the transmission of the detector signals in such a way that signals emitted thereby

are difficult to jam or block. For example, the signals may be sent more than once, in groups more than once, with random delays between the first transmission and subsequent groups of transmissions. The hub 7 which monitors all signals from the detectors 5 can then detect attempts at continuous and intermittant jamming by analysing the nature of the received signal. If the hub 7 detects attempts to block or jam the signal from any of the detectors 5 a signal carrying this information is sent to the monitoring centre 11, which information will assist the monitoring centre 11 in assessing whether there is a false alarm.

The detectors 5 should preferably be arranged to contain intelligence developed in such a way as to maximise the lifetime of the battery. Software is provided to monitor various physical and environmental conditions, so that when there is no activity to monitor, the detector switches into a low power or 'sleep' mode, awakening periodically to re-assess the sensor's surroundings, but when activity does occur the detector automatically 'wakes up'. This technique permits battery lives of 5 to 14 years.

CLAIMS

1. A security system comprising a monitoring centre (11) connected via a communication system to control means (7) at a remote location, and at least one detector (5) associated with said control means (7), each detector (5) being operable to detect an alarm situation and transmit a detector signal to said control means (7), wherein on receipt of said detector signal said control means (7) is operable to inform said monitoring centre (11) of said alarm situation, characterised in that said control means (7) is operable to inform said monitoring centre (11) of said alarm situation by sending an alarm signal thereto and a two way audio communication link is provided between said control means (7) and said monitoring centre (11), so that on receipt of said alarm signal from said control means (7) said monitoring centre (11) is able to verify the alarm situation by using the two way audio communication link, thereby reducing the risk of false alarms.

2. A security system according to claim 1, wherein said detector signal transmitted by each detector (5) is a unique such signal which carries information identifying said detector (5) and said control means (7) is operable to recognise said detector signal, wherein said control means (7) is operable to transmit alarm signals corresponding to detector signals from specified detectors (5) to said monitoring centre (11), so that on receipt of said alarm signal from said control means (7) said monitoring centre (11) is able to identify the detector (5) from which said alarm signal originated and which of the detectors (5) are specified, so that by using the information on the said detectors (5) in cooperation with the two way audio communication link said monitoring centre (11) is able to verify the alarm situation.

3. A security system according to claim 2, wherein said control means (7) has

two modes of operation, in a first one of which all of said detectors (5) at said remote location are specified and in a second one of which not all of said detectors (5) at said remote location are specified.

4. A security system according to claim 3, wherein the said control means (7) are operable in a first mode to send alarm signals to the monitoring centre (11) on receipt of any signals from any of the said detectors (5).

5. A security system according to claim 3 or claim 4 , wherein the said control means (7) are operable in a second mode to send alarm signals to the monitoring station (11) from detectors (5) in a specified zone.

6. A security system according to claim 3 or claim 4 or claim 5, wherein the said control means (7) are operable in a third mode to send alarm signals to the monitoring centre (11) from a specified type of detectors (5).

7. A security system according to any one of the preceding claims, wherein the control means (7) is operable to be set in a given mode using a key pad data entry system (9) and/or a touch tone telephone (14).

8. A security system according to any one of the preceding claims, wherein the monitoring centre (11) is able to detect the sequence of activation of the said detectors (5), thereby assisting in the assessment of the risk.

9. A security system according to any one of claims 1 to 8, wherein the control means (7) is provided with delaying means operable to delay alerting the monitoring centre (11) when a detector signal has been received until a preselected time has elapsed, in order that a user can reset the system before an alarm signal is sent to the monitoring centre (11), when a detector (5) has sent an alarm signal to the said control means (7) but there is no alarm

situation.

10. A security system according to any of the preceding claims, wherein the said communication system is a public switched telephone network system (PSTN) or an integrated services digital network (ISDN) or a cellular or radio telephone network system or a cable network system.

11. A security system according to any of the preceding claims, wherein the said detectors (5) comprise a smoke detector and/or a detector for detecting the presence of intruders and/or a flood detector and/or a gas detector.

12. A security system according to claim 11, wherein the gas to be detected is carbon dioxide.

13. A security system according to claim 11, wherein the smoke detectors (5) are operable to measure smoke density.

14. A security system according to any one of the preceding claims, comprising a user activatable alarm (15), which user alarm (15) is operable to be activated manually and/or by using a radio signal transmitted from a unit carried by the user.

15. A security system according to any one of the preceding claims, wherein the said control means (7) are operable to alert the said monitoring centre (11) by dialling a predetermined telephone number.

16. A security system according to any one of claims 1 to 15, comprising programmable timing means in the control means (7), so that after a preselected period of time a request signal is automatically sent from the control means (7) to the monitoring centre (11) to request that routine

management and maintenance checks are conducted.

17. A security system according to any one of claims 1 to 16, wherein audio alarm means (8) are connected to the control means (7), said audio alarm (8) being operable to produce a sound when an alarm signal is sent to the monitoring centre (11).

18. A control system for use in a security system, which control system comprises control means (7) for connecting to and communicating with a monitoring centre (11) at a remote location, at least one detector (5) associated with said control means (7), each detector (5) being operable to detect an alarm situation and transmit a detector signal to said control means (7), wherein on receipt of said detector signal said control means (7) is operable to inform said monitoring centre (11) of said alarm situation, characterised in that said control means (7) is operable to inform said monitoring centre (11) of said alarm situation by sending an alarm signal thereto, and said control means (7) is adapted to be connected to said monitoring centre (11) so that a two way audio communication link is formed between said control means (7) and said monitoring centre (11), so that on receipt of said alarm signal from said control means (7) said monitoring centre (11) is able to verify the alarm situation by using the two way audio communication link, thereby reducing the risk of false alarms.

19. A monitoring system comprising control means (7) operable to store predetermined information on the average movements of a person over a preselected time interval, monitoring means (5) operable to monitor the actual movements of the person over that time interval, and to transmit information on the actual movements from the monitoring means to the control means (7), said control means (7) being operable to compare the information on the actual movements of the user with the stored information.

20. A monitoring system according to claim 19, wherein the alarm is a siren (8) operable to attract attention to the plight of the user.

21. A monitoring system according to claim 20, wherein the said control means (7) is connected through a communication system to a monitoring centre (11), so that when said control means (7) detects an alarm situation an alarm signal is sent thereby to the said monitoring centre (11).

22. A monitoring system according to claim 23, wherein a two-way audio communication link between the said monitoring centre (11) and the control means (7) is provided.

23. A monitoring system according to claim 22, wherein the system is provided with at least one detector (5) associated with said control means (7), each detector (5) being operable to detect an alarm situation and transmit a detector signal to said control means (7), wherein on receipt of said detector signal said control means (7) is operable to inform said monitoring centre (11) of said alarm situation by sending an alarm signal thereto, so that on receipt of said alarm signal from said control means (7) said monitoring centre (11) is able to verify the alarm situation by using the two way audio communication link, thereby reducing the risk of false alarms.

24. A self testing detector comprising detecting means operable to detect a preselected physical change and send an alarm signal to activate alarm means when such a change is detected, and simulating means operable automatically to produce a signal which causes said detecting means to react as though it detected said physical change.

25. A self testing detector according to claim 24, wherein said simulating means comprise a microprocessor.

26. A self testing detector according to claim 24 or claim 25, wherein said detector is a smoke detector or a gas detector or an infra red radiation detector.

FIG. 1 Typical System